

Give or Take a Few

Reporting Category Patterns, Functions, and Algebra

Topic Graphing inequalities

Materials

- Greater Than, Less Than, and Equal Cards (attached)
- Number Cards (attached)
- Number line for display
- Number line markers (e.g., two-color counters, small bits of paper)
- Give or Take a Few handout (attached)
- Number Line handout (attached)

Vocabulary

number line (earlier grade)

absolute value, integers, inequalities (6.20)

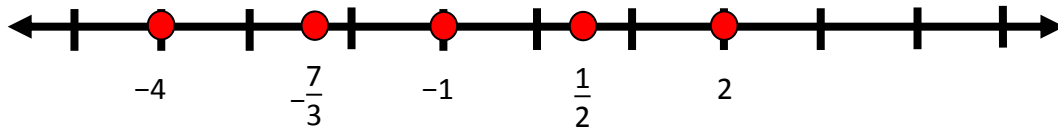
Student/Teacher Actions (what students and teachers should be doing to facilitate learning)

The concepts involved in graphing inequalities on a number line are directly connected to the concepts contained in SOL 6.3; therefore, it is highly recommended to use SOL 6.3 as a basis for teaching students about graphing inequalities on a number line.

Prior to the lesson, copy the attached Greater Than Cards, Less Than Cards, Equal Cards, and Number Cards on cardstock, and cut them apart. In addition to the sample number cards attached, it is recommended to create additional number cards to provide more practice. Of course, cards can be reused by pairing them with different cards.

1. Distribute a Greater Than Card, Less Than Card, and Equal Card to each student. Open the lesson by displaying different combinations of two number cards side-by-side and having students respond by holding up one of their Greater Than Cards, Less Than Cards, or Equal Cards. The number cards that you display should contain a mixture of whole numbers, integers, rational numbers, and simple equations. Encourage students to select responses and stick to them, but challenge them also to defend their responses. This part of the lesson will allow students to display their understanding of integers, fractions, decimals, and the four operations (SOL 6.2, 6.3, 6.6).

2. Display a number line, and begin placing the number cards in the appropriate locations on it. If necessary, remind students about directions on a number line: values decrease when moving to the left and increase when moving to the right. Using the numbers on the number line, begin questioning students about how to represent certain areas of the number line without listing each value. For example, show the following numbers on the number line:



- Have students use inequality symbols ($<$ or $>$) to name three relationships that describe the placement of these numbers on the number line. Ask students whether 2 is greater than only the numbers listed. When they answer no, ask what other numbers 2 is greater than. Ask students to come up with a way to show that 2 can be *strictly* greater than any number among a set of many numbers. If they have difficulty with this concept, ask questions leading them to the use of a variable representing “any number.” This discussion should enable them to arrive at the expression $2 > x$.
3. Ask students whether there is another way to express $2 > x$ with a different inequality. This should lead them to the expression $x < 2$. Make sure to explain that x represents *all* values that are less than 2. Also, re-emphasize that the order and the symbol direction matter in inequality expressions.
4. Distribute copies of the Give or Take a Few handout, and explain each of the symbols that describe relationships between numbers. Have students develop a class definition for each symbol and then create a class example for each to list in the chart. Place specific attention on \leq and \geq . Explain that in the expression $x < 2$, every number less than 2 makes the expression true. Ask them whether 2 can ever be less than 2 and whether 2 can ever be greater than 2. The symbols $<$ and $>$ may be used only for numbers that are strictly less than or greater than 2, not for 2 itself, which is the number that acts as a “boundary.” On the other hand, the symbols \leq or \geq include the “boundary” number—therefore, *every* number on the number line.
5. Explain the following steps for graphing an inequality on a number line, using $x < 2$ as an example:
- Locate the boundary number on the number line.
 - Decide whether the circle indicating the point on the line is open or closed. (It is closed if the inequality sign has an equal sign underneath.)
 - Decide whether values less than or greater than the boundary number will satisfy the expression.
 - Shade the number line on the side of the boundary number that makes the expression true.
6. Emphasize to students that they should not trust the direction of the symbol for shading the number line. If they are unsure, they should choose a test number from each side of the boundary number: whichever test number makes the expression true indicates the side of the number line to shade.

7. Model graphing $x < 2$ on the number line, following the steps above. Direct students to shade the entire number line on the correct side of the boundary number and draw an arrow (a ray) at the end of the number line to show that the shading extends beyond the represented portion of the number line.
8. Distribute copies of the attached Number Line handout, and have students use it to graph other inequalities. Include inequalities that have both open and closed circles.
9. Close the lesson by having students explain the step-by-step process for graphing inequalities. Pay close attention to make sure they remember the most important points of shading and opening or closing the circle.

Assessment

- **Questions**
 - What are the primary differences between graphing an expression equal to x (graphing an equality) and graphing an expression including x and an inequality (graphing an inequality)?
 - What does the arrow at the end of a shaded number line indicate?
- **Journal/Writing Prompts**
 - Describe an occupation that relies on the use of inequalities (approximating amounts).
 - A new student has joined our class and is having difficulty with deciding when to use closed or open circles for graphing inequalities. Provide him with a basic rule or hint to assist him when graphing.

Extensions and Connections (for all students)

- Have students do a matching activity in which they match various expressions involving inequalities with their graphs.

Strategies for Differentiation

- Give each student an “Inequality Question Card” to use with each graphing problem. The card should feature the following questions/directions:
 - Graph the boundary number.
 - Is the circle open or closed?
 - What is a value to the left of the boundary number?
 - What is a value to the right of the boundary number?
 - Which number—the one on the right or the one on the left—makes the expression true?
 - Shade the number line in that direction, and finish the line off with an arrow.

Give or Take a Few

Name _____ Date _____

Below are the symbols used to describe the relationships between numbers. Write the class definition of each symbol, and then list the class example of each.

Symbol	Definition	Example
$=$		
\neq		
$<$		
$>$		
\leq		
\geq		

List the steps for graphing inequalities. Add more bullets, if necessary.

- _____
- _____
- _____
- _____

Greater Than Cards

>

>

>

>

Less Than Cards

<

<

<

<

Equal Cards

=

=

=

=

Number Cards

$$18 - 19$$

$$-1$$

$$\frac{2}{3}$$

$$\frac{7}{10}$$

$$-100$$

$$3 \cdot \frac{4}{18}$$

$$-3 \cdot \frac{2}{3}$$

$$-1,000$$

$$0.75$$

$$-11 - 31$$

$$42$$

$$125 \div 25$$

Number Lines

